

Listing of Claims:

1. (currently amended) A control apparatus, comprising:

a controller;

a detecting device for providing ~~an~~ analog signals in response to ~~a~~ pressures applied to ~~a~~ said ~~the~~ controller during normal operation of the controller and an analog calibration signal in response to an initial calibrating pressure applied to the controller; and

an output unit including a level segmenting unit for segmenting an output level of the analog calibration signal into predetermined calibration levels based on the initial calibrating pressure and for segmenting an output level of the analog signals into predetermined levels during normal operation, and an analog-to-digital (A/D) converting unit for converting the predetermined levels into segmented output level of the analog signal into a digital signals each having a plurality of bits.

2. (previously amended) An apparatus according to Claim 1, wherein said detecting device is a pressure-sensitive device which is arranged at a position relative to said controller such that a pressure acting on said controller is transmitted to said detecting device.

3. (previously amended) An apparatus according to Claim 1, wherein said detecting device comprises:

a resistor; and

a conductive member which moves together with said controller for contacting said resistor; and

wherein said conductive member has elasticity, and the output level of the analog signal corresponds to a contact area between said resistor and said conductive member.

4. (previously amended) An apparatus according to Claim 1, wherein said detecting device includes:

a conductive member; and

a resistor which moves together with said controller for contacting said conductive member;

wherein said conductive member has elasticity, and the output level of the analog signal corresponds to a contact area between said resistor and said conductive member.

5. (previously amended) An apparatus according to Claim 3 or 4, wherein said conductive member is deformable and a size of the contact area is a function of a contact pressure exerted on said conductive member by said resistor.

C1 6. (original) An apparatus according to Claim 5, wherein said conductive member is formed with a shape having a peaked longitudinal-section surface.

7. (original) An apparatus according to Claim 5, wherein said conductive member is formed with a shape having a trapezoidal longitudinal-section surface.

8. (previously amended) An apparatus according to Claim 5, wherein said conductive member is formed with a shape having a cross-sectional area which decreases stepwise toward a portion which faces said resistor.

9. (original) An apparatus according to Claim 5, wherein said conductive member is formed with a spherical surface which faces said resistor.

~~10. (original) An apparatus according to Claim 3 or 4, wherein~~
said resistor is formed with a shape having a cross-sectional area which decreases toward a top portion which faces said conductive member.

11. (original) An apparatus according to Claim 10, wherein said resistor is formed with a shape having a peaked longitudinal-section surface.

12. (original) An apparatus according to Claim 10, wherein said resistor is formed with a shape having a trapezoidal longitudinal-section surface.

13. (original) An apparatus according to Claim 10, wherein said resistor is formed with a spherical surface which faces said conductive member.

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14. (previously amended) An apparatus according to Claim 3 or 4, wherein said resistor is formed with a shape having a cross-sectional area which decreases stepwise toward a portion which faces said conductive member.

15. (previously amended) An apparatus according to Claim 3 or 4, wherein said conductive member is deformable in accordance with a contact pressure exerted on said conductive member by said resistor such that a size of the contact area between said conductive member and said resistor changes; and said resistor comprises non-conductive regions such that the contact area increases stepwise.

16. (previously cancelled)

17. ~~(previously amended)~~ An apparatus according to Claim 1, wherein said level segmenting unit uniformly segments the output level of the analog signal.

18. (currently amended) A control apparatus, comprising:

a controller;

a detecting device which provides ~~an~~ analog signals in response to ~~a~~ pressures applied to said controller during normal operation of the controller and an analog calibration signal in response to an initial calibrating pressure applied to the controller, said detecting device including a resistor and a conductive member which moves together with said controller for contacting said resistor, where said conductive member has elasticity, and an output level of the analog signal corresponds to a contact area between said resistor and said conductive member;

C (a level segmenting unit for segmenting the output level of the analog calibration signal into predetermined calibration levels based on the initial calibrating pressure and for segmenting an output level of the analog signals into predetermined levels during normal operation; and

an analog-to-digital (A/D) converting unit for converting the predetermined levels into segmented output level of the analog signal into a digital signals each having a plurality of bits.

19. (currently amended) A control apparatus, having a controller and a detecting device which provides ~~an~~ analog signals in response to ~~a~~ pressures applied to said controller, wherein said control apparatus further comprises an output unit comprising:

a controller;

~~a detecting device which provides an analogs signal in response to a pressures applied to said controller during normal operation of the controller and an analog calibration signal in response to an initial calibrating pressure applied to the controller,~~ said detecting device including a conductive member and a resistor which moves together with said controller for contacting said conductive member, where said conductive member has elasticity, and an output level of the analog signal corresponds to a contact area between said resistor and said conductive member;

a level segmenting unit for segmenting the output level of the analog calibration signal into predetermined calibration levels based on the initial calibrating pressure and for segmenting an output level of the analog signals into predetermined levels during normal operation; and

an A/D converting unit for converting the predetermined levels into segmented output level of the analog signal into a digital signals each having a plurality of bits.

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20. (previously amended) A control apparatus according to Claim 18 or 19, wherein said conductive member is deformable and a size of the contact area is a function of a contact pressure exerted on said conductive member by said resistor.

21. (original) A device according to Claim 20, wherein said conductive member is formed with a shape having a peaked longitudinal-section surface.

22. (original) A device according to Claim 20, wherein said conductive member is formed with a shape having a trapezoidal longitudinal-section surface.

~~23. (previously amended) A device according to Claim 20, wherein said conductive member is formed with a shape having a cross-sectional area which decreases stepwise towards a portion that faces said resistor.~~

24. (original) A device according to Claim 20, wherein said conductive member is formed with a shape having a spherical surface which faces said resistor.

25. (original) A device according to Claim 18 or 19, wherein said resistor is formed with a shape having a cross-sectional area which decreases towards a top portion that faces said conductive member.

C1 26. (original) A device according to Claim 25, wherein said resistor is formed with a shape having a peaked longitudinal-section surface.

27. (original) A device according to Claim 25, wherein said resistor is formed with a shape having a trapezoidal longitudinal-section surface.

28. (original) A device according to Claim 25, wherein said resistor is formed with a shape having a spherical surface which faces said conductive member.

29. (previously amended) A device according to Claim 18 or 19, wherein said resistor is formed with a shape having a cross-sectional area which decreases stepwise towards a portion that faces said conductive member.

30. (previously amended) A device according to Claim 18 or 19, wherein said conductive member is deformable in accordance with a contact pressure exerted on said conductive member by said resistor such that a size of the contact area between said conductive member and said resistor changes; and said resistor comprises non-conductive regions such that the contact area increases stepwise.

31. (currently amended) A control apparatus, comprising:

a controller;

C 1 a detecting device for providing ~~an~~ analog signals in response to ~~a~~ pressures applied to said controller during normal operation of the controller and an analog calibration signal in response to an initial calibrating pressure applied to the controller; and

an output unit for segmenting an output level of the analog calibration signal into predetermined calibration levels based on the initial calibrating pressure and for segmenting an output level of the analog signals into predetermined levels during normal operation and for converting the predetermined levels into segmented output level of the analog signal into a digital signals each having a plurality of bits;

wherein said detecting device has a conductive member and a resistor, and a contact area between said conductive member and said resistor increases stepwise with an increase in said pressure applied to said controller, and the output level of the analog signal corresponds to the contact area between said resistor and said conductive member.

32. (previously added) An apparatus according to claim 31, wherein said conductive member moves together with said controller for contacting said resistor such that the output

level of the analog signal corresponds to the contact area between said resistor and said conductive member, and said conductive member has elasticity.

33. (previously added) An apparatus according to claim 31, wherein said resistor moves together with said controller for contacting said conductive member such that the output level of the analog signal corresponds to the contact area between said resistor and said conductive member, and said conductive member has elasticity.

C (34. (previously added) An apparatus according to claims 32 or 33, wherein said conductive member is formed with a shape having a cross-sectional area which decreases stepwise toward a portion which faces said resistor.

35. (previously added) An apparatus according to claims 32 or 33, wherein said resistor is formed with a shape having a cross-sectional area which decreases stepwise toward a portion which faces said conductive member.

36. (previously added) An apparatus according to claims 32 or 33, wherein said conductive member is deformable in accordance with a contact pressure exerted on said conductive member by said resistor such that a size of the contact area changes; and said resistor comprises non-conductive regions such that the contact area increases stepwise.

37. (previously added) A device for use in a control apparatus having a controller which provides an analog signals in response to pressures applied to said controller during normal operation of the controller and an analog calibration signal in response

to an initial calibrating pressure applied to the controller,
said device comprising:

an output unit for segmenting an output level of the analog calibrating signal into predetermined calibration levels based on the initial calibrating pressure and for segmenting an output level of the analog signals into predetermined levels during normal operation and for converting the predetermined levels into segmented output level of the analog signal into a digital signals each having a plurality of bits;

a conductive member; and

a resistor;

wherein a contact area between said conductive member and said resistor increases stepwise with an increase in the pressure applied to said controller, and the output level of the analog signal corresponds to the contact area between said resistor and said conductive member.

38. (previously added) An apparatus according to claim 37, wherein said conductive member moves together with said controller for contacting said resistor such that the output level of the analog signal corresponds to the contact area between said resistor and said conductive member, and said conductive member has elasticity.

39. (previously added) An apparatus according to claim 37, wherein said resistor moves together with said controller for contacting said conductive member such that the output level of the analog signal corresponds to the contact area between said resistor and said conductive member, and said conductive member has elasticity.

40. (previously added) An apparatus according to claims 38 or 39, wherein said conductive member is formed with a shape having a cross-sectional area which decreases stepwise toward a portion which faces said resistor.

41. (previously added) An apparatus according to claims 38 or 39, wherein said resistor is formed with a shape having a cross-sectional area which decreases stepwise toward a portion which faces said conductive member.

42. (previously added) An apparatus according to claims 38 or 39, wherein said conductive member is deformable in accordance with a contact pressure exerted on said conductive member by said resistor such that a size of the contact area changes; and said resistor comprises non-conductive regions such that the contact area increases stepwise.

43. (currently amended) A method of generating a signal representative of a pressure applied to a control apparatus, comprising:

(a) generating ~~an~~ analog signals representative of pressures applied to the controller apparatus during normal operation of the control apparatus;

(b) generating an analog calibration signal in response to an initial calibrating pressure applied to the control apparatus;

(~~b~~c) segmenting the output level of the analog calibration signal into predetermined calibration levels based on the initial calibrating pressure;

(d) segmenting an output level of the analog signals into predetermined levels during normal operation~~analog output levels;~~ and

~~(ee)~~ assigning preset digital signals corresponding to each of the analog output levels.

44. (currently amended) A method of generating a signal representative of a ~~pressures~~ applied to a control apparatus comprising a controller including a resistor and an elastic conductive member which moves together with the controller for contacting the resistor, comprising:

(a) generating ~~an~~ analog signals corresponding to a contact area between the resistor and the conductive member during normal operation of the controller;

(b) generating an analog calibration signal in response to an initial calibrating pressure applied to the control apparatus;

c { (c) segmenting the output level of the analog calibration signal into predetermined calibration levels based on the initial calibrating pressure;

(d) segmenting an output level of the analog signals into predetermined levels during normal operation ~~analog output levels;~~ and

(ee) assigning preset digital signals corresponding to each of the analog output levels.

45. (previously added) The method as claimed in claim 44, wherein the resistor increases stepwise with an increase in said pressure applied to said controller.

46. (new) An apparatus according to Claim 1, wherein the output unit calibrates the control apparatus by ascertaining a maximum output level from the detecting device based on a maximum applied pressure such that the level segmenting unit divides the predetermined levels equally up to the maximum output level.

47. (new) An apparatus according to Claim 18 or 19, wherein the level segmenting unit calibrates the control apparatus by ascertaining a maximum output level from the detecting device based on a maximum applied pressure and dividing the predetermined levels equally up to the maximum output level.

48. (new) An apparatus according to Claim 31 or 37, wherein the output unit calibrates the controller by ascertaining a maximum output level from the detecting device based on a maximum applied pressure such that the output unit divides the predetermined levels equally up to the maximum output level.

49. (new) The method as claimed in claims 43 or 44, further comprising calibrating the control apparatus by ascertaining a maximum output level of the analog calibration signal based on a maximum applied pressure and dividing the predetermined levels equally up to the maximum output level.

50. (new) A control apparatus, comprising:

a controller;

a detecting device for providing an analog signal in response to an initial calibrating pressure applied to the controller; and

an output unit including a level segmenting unit for segmenting an output level of the analog signal into predetermined calibration levels based on the initial calibrating pressure, and an analog-to-digital (A/D) converting unit for converting the predetermined calibration levels into digital signals each having a plurality of bits.

51. (new) An apparatus according to Claim 50, wherein said detecting device is a pressure-sensitive device which is arranged at a position relative to said controller such that a pressure acting on said controller is transmitted to said detecting device.

52. (new) An apparatus according to Claim 50, wherein said detecting device comprises:

a resistor; and

a conductive member which moves together with said controller for contacting said resistor; and

wherein said conductive member has elasticity, and the output level of the analog signal corresponds to a contact area between said resistor and said conductive member.

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53. (new) An apparatus according to Claim 50, wherein said detecting device includes:

a conductive member; and

a resistor which moves together with said controller for contacting said conductive member;

wherein said conductive member has elasticity, and the output level of the analog signal corresponds to a contact area between said resistor and said conductive member.

54. (new) An apparatus according to Claim 52 or 53, wherein said conductive member is deformable and a size of the contact area is a function of a contact pressure exerted on said conductive member by said resistor.

55. (new) An apparatus according to Claim 54, wherein said conductive member is formed with a shape having a peaked longitudinal-section surface.

56. (new) An apparatus according to Claim 54, wherein said conductive member is formed with a shape having a trapezoidal longitudinal-section surface.

57. (new) An apparatus according to Claim 54, wherein said conductive member is formed with a shape having a cross-sectional area which decreases stepwise toward a portion which faces said resistor.

58. (new) An apparatus according to Claim 54, wherein said conductive member is formed with a spherical surface which faces said resistor.

C 59. (new) An apparatus according to Claim 52 or 53, wherein said resistor is formed with a shape having a cross-sectional area which decreases toward a top portion which faces said conductive member.

60. (new) An apparatus according to Claim 59, wherein said resistor is formed with a shape having a peaked longitudinal-section surface.

61. (new) An apparatus according to Claim 59, wherein said resistor is formed with a shape having a trapezoidal longitudinal-section surface.

62. (new) An apparatus according to Claim 59, wherein said resistor is formed with a spherical surface which faces said conductive member.

~~63. (new) An apparatus according to Claim 52 or 53, wherein said~~
resistor is formed with a shape having a cross-sectional area which decreases stepwise toward a portion which faces said conductive member.

64. (new) An apparatus according to Claim 52 or 53, wherein said conductive member is deformable in accordance with a contact pressure exerted on said conductive member by said resistor such that a size of the contact area between said conductive member and said resistor changes; and said resistor comprises non-conductive regions such that the contact area increases stepwise.

C 65. (new) An apparatus according to Claim 50, wherein said level segmenting unit uniformly segments the output level of the analog signal.

66. (new) A control apparatus, comprising:

a controller;

a detecting device which provides an analog signal in response to an initial calibrating pressure applied to said controller, said detecting device including a resistor and a conductive member which moves together with said controller for contacting said resistor, where said conductive member has elasticity, and an output level of the analog signal corresponds to a contact area between said resistor and said conductive member;

a level segmenting unit for segmenting the output level of the analog signal into predetermined calibration levels based on the initial calibrating pressure; and

~~an analog-to-digital (A/D) converting unit for converting~~
the predetermined calibration levels into digital signals each having a plurality of bits.

67. (new) A control apparatus, having a controller and a detecting device which provides an analog signal in response to a pressure applied to said controller, wherein said control apparatus further comprises an output unit comprising:

a controller;

a detecting device which provides an analog signal in response to a pressure applied to said controller, said detecting device including a conductive member and a resistor which moves together with said controller for contacting said conductive member, where said conductive member has elasticity, and an output level of the analog signal corresponds to a contact area between said resistor and said conductive member;

a level segmenting unit for segmenting the output level of the analog signal into predetermined calibration levels based on the initial calibrating pressure; and

an A/D converting unit for converting the predetermined calibration levels into digital signals each having a plurality of bits.

68. (new) A control apparatus according to Claim 66 or 67, wherein said conductive member is deformable and a size of the contact area is a function of a contact pressure exerted on said conductive member by said resistor.

69. (new) A device according to Claim 68, wherein said conductive member is formed with a shape having a peaked longitudinal-section surface.

70. (new) A device according to Claim 68, wherein said conductive member is formed with a shape having a trapezoidal longitudinal-section surface.

71. (new) A device according to Claim 68, wherein said conductive member is formed with a shape having a cross-sectional area which decreases stepwise towards a portion that faces said resistor.

72. (new) A device according to Claim 68 wherein said conductive member is formed with a shape having a spherical surface which faces said resistor.

C(73. (new) A device according to Claim 66 or 67, wherein said resistor is formed with a shape having a cross-sectional area which decreases towards a top portion that faces said conductive member.

74. (new) A device according to Claim 73, wherein said resistor is formed with a shape having a peaked longitudinal-section surface.

75. (new) A device according to Claim 73, wherein said resistor is formed with a shape having a trapezoidal longitudinal-section surface.

76. (new) A device according to Claim 73, wherein said resistor is formed with a shape having a spherical surface which faces said conductive member.

77. (new) A device according to Claim 66 or 67, wherein said resistor is formed with a shape having a cross-sectional area

which decreases stepwise towards a portion that faces said conductive member.

78. (new) A device according to Claim 66 or 67 wherein said conductive member is deformable in accordance with a contact pressure exerted on said conductive member by said resistor such that a size of the contact area between said conductive member and said resistor changes; and said resistor comprises non-conductive regions such that the contact area increases stepwise.

79. (new) A control apparatus, comprising:

a controller;

CI a detecting device for providing an analog signal in response to an initial calibrating pressure applied to said controller; and

an output unit for segmenting an output level of the analog signal and for converting the segmented output level of the analog signal into a predetermined calibration levels based on the initial calibration pressure and for converting the predetermined calibration levels into digital signals each having a plurality of bits;

wherein said detecting device has a conductive member and a resistor, and a contact area between said conductive member and said resistor increases stepwise with an increase in said pressure applied to said controller, and the output level of the analog signal corresponds to the contact area between said resistor and said conductive member.

80. (new) An apparatus according to claim 79, wherein said conductive member moves together with said controller for contacting said resistor such that the output level of the

~~analog signal corresponds to the contact area between said~~
resistor and said conductive member, and said conductive member
has elasticity.

81. (new) An apparatus according to claim 79, wherein said
resistor moves together with said controller for contacting said
conductive member such that the output level of the analog
signal corresponds to the contact area between said resistor and
said conductive member, and said conductive member has
elasticity.

C(82. (new) An apparatus according to claims 80 or 81, wherein
said conductive member is formed with a shape having a cross-
sectional area which decreases stepwise toward a portion which
faces said resistor.

83. (new) An apparatus according to claims 80 or 81, wherein
said resistor is formed with a shape having a cross-sectional
area which decreases stepwise toward a portion which faces said
conductive member.

84. (new) An apparatus according to claims 80 or 81, wherein
said conductive member is deformable in accordance with a
contact pressure exerted on said conductive member by said
resistor such that a size of the contact area changes; and said
resistor comprises non-conductive regions such that the contact
area increases stepwise.

~~85. (new) A device for use in a control apparatus having a~~
controller which provides an analog signal in response to an
initial calibrating pressure applied to said controller, said
device comprising:

an output unit for segmenting an output level of the analog
signal into predetermined calibration levels based on the
initial calibration pressure and for converting the
predetermined calibration levels into digital signals each
having a plurality of bits;

a conductive member; and

a resistor;

wherein a contact area between said conductive member and
said resistor increases stepwise with an increase in the
pressure applied to said controller, and the output level of the
analog signal corresponds to the contact area between said
resistor and said conductive member.

86. (new) An apparatus according to claim 85, wherein said
conductive member moves together with said controller for
contacting said resistor such that the output level of the
analog signal corresponds to the contact area between said
resistor and said conductive member, and said conductive member
has elasticity.

87. (new) An apparatus according to claim 85, wherein said
resistor moves together with said controller for contacting said
conductive member such that the output level of the analog
signal corresponds to the contact area between said resistor and
said conductive member, and said conductive member has
elasticity.

88. (new) ~~An apparatus according to claims 86 or 87, wherein~~
said conductive member is formed with a shape having a cross-sectional area which decreases stepwise toward a portion which faces said resistor.

89. (new) An apparatus according to claims 86 or 87, wherein said resistor is formed with a shape having a cross-sectional area which decreases stepwise toward a portion which faces said conductive member.

90. (new) An apparatus according to claims 86 or 87, wherein said conductive member is deformable in accordance with a contact pressure exerted on said conductive member by said resistor such that a size of the contact area changes; and said resistor comprises non-conductive regions such that the contact area increases stepwise.

91. (new) A method of generating a signal representative of a pressure applied to a control apparatus, comprising:

(a) generating an analog signal representative of an initial pressure applied to the controller;

(b) segmenting the output level of the analog signal into predetermined calibration levels based on the initial calibrating pressure; and

(c) assigning preset digital signals corresponding to each of the predetermined calibration levels.

92. (new) A method of generating a signal representative of a pressure applied to a control apparatus comprising a controller including a resistor and an elastic conductive member which moves together with the controller for contacting the resistor, comprising:

~~(a) generating an analog signal corresponding to a contact~~
area between the resistor and the conductive member, including
generating an initial calibrating pressure applied to the
controller;

(b) segmenting the output level of the analog signal into
predetermined calibration levels based on the initial
calibration pressure; and

(c) assigning preset digital signals corresponding to each
of the predetermined calibration levels.

93. (new) The method as claimed in claim 92, wherein the
resistor increases stepwise with an increase in said pressure
applied to said controller.

C (94. (new) An apparatus according to Claim 50, wherein the
output unit calibrates the control apparatus by ascertaining a
maximum output level from the detecting device based on a
maximum applied pressure such that the level segmenting unit
divides the predetermined levels equally up to the maximum
output level.

95. (new) An apparatus according to Claim 66 or 67, wherein the
level segmenting unit calibrates the control apparatus by
ascertaining a maximum output level from the detecting device
based on a maximum applied pressure and dividing the
predetermined levels equally up to the maximum output level.

96. (new) An apparatus according to Claim 79 or 85, wherein the
output unit calibrates the controller by ascertaining a maximum
output level from the detecting device based on a maximum
applied pressure such that the output unit divides the
predetermined levels equally up to the maximum output level.

C/ 97. (new) The method as claimed in claims 91 or 92, further comprising calibrating the control apparatus by ascertaining a maximum output level of the analog calibration signal based on a maximum applied pressure and dividing the predetermined levels equally up to the maximum output level.
